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ABSTRACT

Materials used in a mathematics methods course for pre-service elementary teachers are listed in this document. The course is comprised of nine modules covering the following areas: the learning of mathematics, sets and classification, counting and numbers, numeration systems, place value numeration systems, operations on whole numbers, operations on rational numbers, measurement, and geometry for the elementary school. Each module consists of a goal statement, a list of objectives, activities designed to assist the student in achieving the stated objectives, and methods of evaluation. The activities are keyed to a bibliography and a list of supplementary materials. (DT)

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Mathematics 324

A Modularized Methods Course For Pre-service Elementary Teachers

by

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Introduction

Several years ago, a CUPM report called for an increase in the amount of mathematics required for prospective elementary school teachers at the undergraduate level. Many colleges have found it economically unfeasible to implement this recommendation. Therefore, many colleges still require three to six hours of mathematics for pre-service teachers rather than the twelve suggested by CUPM.

Paine College requires six hours of mathematics preparation for its preservice teachers. The first course, Math 120, is a liberal arts mathematics course required of teacher education, sociology, history and English majors. The course includes sets, logic, statistics, probability and computer science. Mathematics 324 is the methods course required of all pre-service elementary education majors. Obviously, it is not possible to include in this course all those topics which were suggested by the CUPM. The present course is comprised of nine modules which have been constructed to cover those topics not covered in Math 120 or thought to be particularly difficult or important for the elementary teacher.

The modular approach was adopted because it allows more material to be covered than traditional types of instruction. The modular construction also allows each student to not only receive an overview of all grade levels but to select a particular level to specialize in. Each module consists of a goal statement, a list of objectives, activities designed to assist the student in achieving the stated objectives, and methods of evaluation. The activities are keyed to a bibliography and a list of supplementary materials. Students work independently and are able through the required lesson plans to develop teaching ideas for the grade level(s) they choose. The scope and sequence charts required in certain modules give the student an opportunity to develop an overall perspective of the topic at all grade levels.

Supplementary Materials List

Manipulatives

Cuisenaire Rods
Cuisenaire Geoboards
Centimeter Cubes
Counting Sticks by Creative Publications
Unifix Math Lab Kit by Creative Publications
Attribute Blocks by Creative Publications
Place Value Board by Ideal

Printed Material

Math Fun Activity Cards by Frank Schaffer Publishers Inc.
Super Math Activity Cards by Frank Schaffer Publishers Inc.
Contemporary Math Readiness Activity Cards by Frank Schaffer Publishers Inc.
Mathways by Scott Resources
Happy Math by Scott Resources
Elementary text series from several publishers

Audio-Visual Materials

A Curriculum Coordinated Slide System - Algebra 500
by Harcourt Brace Jovanovich

Harbrace Mathematical Instructional Slides by Harcourt Brace Jovanovich
Cartridge A Addition and Subtraction of Whole Numbers
Cartridge B Multiplication and Division of Whole Numbers
Cartridge D Rational Numbers

Fundamentals of Mathematics by Harper and Row
Unit II Module 1 Sets
Unit II Module 2 Real Number System

Think Metric by Denoyer-Geppert Audio-Visuals

Introduction to the Metric System by Weber Costello

Encyclopedia Britannica Super 8 Filmloops

COURSE OUTLINE

Math 324

Each module consists of a list of objectives, a set of activities and criteria for evaluation.

Module 1	The Learning of Mathematics
Module 2	Sets and Classification
Module 3	Counting and Numbers
Module 4	Numeration Systems
Module 5	Place Value Numeration Systems
Module 6	Operations on Whole Numbers
Module 7	Operations on Rational Numbers
Module 8	Measurement
Module 9	Geometry for the Elementary School

Bibliography

1. Ashlock, Robert and Herman, Wayne; Current Research in Elementary School Mathematics, MacMillam, 1970.
2. Begle, Ed ed. Sixty-ninth Yearbook of the National Society for the Study of Education, NSSE, 1970.
3. Copeland, Richard, Diagnostic and Learning Activities in Mathematics for Children, MacMillan, 1974.
4. Courant, Richard and Robbins, Herbert, What Is Mathematics, Oxford University Press, 1941.
5. Crosswhite, F. Joe and others; Teaching Mathematics: Psychological Foundations, Jones Publishing Co., 1973.
6. D'Augustine, Charles Multiple Methods of Teaching Mathematics in the Elementary School, Harper and Row, 1968.
7. Jencks, Stanley and Peck, Donald Building Mental Imagery in Mathematics,
8. Kline, Morris, Why Johnny Can't Add, St. Martin's Press, 1973.
9. Maertens, Norbert and Dunlop, William: Meeting Individual Needs in Elementary Mathematics, Dryden Press, Hinsdale, Illinois, 1973.
10. National Council Of Teachers Of Mathematics; A History of Mathematics Education in the United States and Canada, NCTM, 1970.
11. NCTM; Instructional Aids in Mathematics, NCTM, 1973.
12. NCTM Piagetian Cognitive-Development Research and Mathematics Education, NCTM, 1971.

13. Newman, James,ed. The World of Mathematics, Vol. 1-4, Simon and Schuster, 1956.

14. Popham, W. James Evaluating Instruction, Prentice-Hall, 1973.

15. Spitzer, Henry Teaching Elementary School Mathematics, Houghton Mifflin, 1967.

16. Swenson, Esther Teaching Mathematics to Children, MacMillan, 1973.

17. Turner, Ethel Teaching Aids for Elementary Mathematics, Holt, Rinehart and Winston, 1966.

18. Underhill, Robert G. Teaching Elementary School Mathematics, Charles E. Merrill Publishing Co.,1972.

MODULE 1
The Learning of Mathematics

Goal: To introduce statements about the nature of mathematics, to relate these to observed problems in the learning of mathematics and to utilize several organized theories of learning to present possible explanations and solutions for these problems.

Objectives: The student will:

1. Be able to state several interpretations of what mathematics is.
2. Be able to list, from personal experience and from class discussion, several problems in the learning of mathematics.
3. Be able to state a definition for a mathematical concept.
4. Be able to illustrate a method for aiding the process of concept formation by a child.
5. Be able to state the basic premises of Piaget's theory of child development.
6. Be able to state the basic premises of Bruner's theory of instruction.
7. Be able to state Gagne's 8 types of learning.
8. Be able to relate Piaget's, Bruner's and Gagne's theories to specific instructional situations.

Activities:

1. Read pp. xv - xiv in Courant and Robbins.
2. Read pp. 1619 - 1634; 1773 - 1783 in Vol. 3 of Newman.
3. Read pp. 2 - 9 in Spitzer.
4. Read The Progressive Nature of Learning in Mathematics by Brownell in Crosswhite.
5. Read chapter 2 in Skemp.
6. Listen to the Phono-tape cassette on Child Development by Jean Piaget (available in the library).
7. Read Piaget's Interviews in Crosswhite. Do exercises #1,2.
8. Read the section on number (Exp. 7 - 12) and measurement (Exp. 23 - 26) in Copeland.
9. Conduct several Piagetian type interviews with children 3 - 7 years. Record the results in detail.
10. Read "Varieties of Learning" by Gagne in Crosswhite. Do exercises 1,6,11,12.
11. Read "Some Basic Processes Involved in Mathematics Learning" by Dienes in Ashlock.
12. Read pp. 10 - 15 in Underhill.

Evaluation:

1. Submit exercises in Activities 7 and 10.
2. Submit detailed accounts of 2 Piagetian interviews. One should involve an experiment with conservation of numbers and the other an experiment with conservation of length.
3. In a written quizz, the student will respond to instructional situations by applying one of several learning theories.

MODULE 2
Sets and Classification

Goal: To develop within the pre-service teacher a knowledge of elementary set theory, how to communicate this knowledge to elementary students and how to relate this knowledge to the total elementary mathematics program.

Objectives: The student will:

1. Be able to discriminate well-defined sets from those which are not well-defined.
2. Be able to construct sets using both the rule and roster method.
3. Be able to define and give multiple descriptions of the basic set operations: union, intersection, complement.
4. Be able to illustrate various set operations using Venn diagrams.
5. Define and use the concept of the empty set.
6. Define and use the concept of the universal set.
7. Define and use the concept of a subset.
8. Be able to demonstrate ways a teacher would develop the concepts and operations above with K - 6 children. This would include a teaching technique, appropriate teaching aides and activities.
9. Define classification.
10. Be able to assist children in making increasingly complex classifications.
11. Be able to select appropriate activities for teaching sets, set operations and classification based on the child's stage of development.

Activities:

1. Utilize at least 2 physical materials to develop activities designed to aid a child in investigating sets and set operations.
2. Utilize at least 2 physical materials to develop activities designed to assist a child in being able to do increasingly complex classification.
3. Work chapters 1 and 2 in Matchett and Snader.
4. Work through Unit II Module 1 of the Harper and Row filmstrip/cassette series.
5. View film loops S-80084; S-80873.
6. Review at least 2 different elementary mathematics text series. Note the sequence of development, activities used and appropriate grade levels for sets and set operations.
7. Review the Georgia State Department of Education guidelines to determine those topics included in the Georgia program.
8. Read "Sets: A Pandora's Box?" in School Science and Mathematics, June 1973.

Evaluation:

1. A forty-five minute written quizz on the stated objectives.
2. A lesson plan which details a sequence of instruction designed to assist a child in learning a selected topic involving sets.
3. Write descriptions of activities developed in Activities 1 and 2.

MODULE 3
Counting Numbers

Goal: To prepare pre-service teachers to help children develop a concept of number; including concepts of quantity, one-to-one correspondence, number order, greater than - equal to - less than, number patterns and the structure of our number system.

Objectives: The student will:

1. Be able to identify and give examples of the major classification of our number system.
2. Be able to identify and illustrate one-to-one correspondence with matching and non-matching sets.
3. Be able to define and use the concept of cardinality of a set.
4. Be able to define and use the concept of ordinal numbers.
5. Be able to define and discriminate between the concepts of number and numeral.
6. Be able to explain Piaget's experiments and stages of the child's development as they relate to "Conservation of Numberness".
7. Be able to discriminate between rote and rational counting, given examples of students' behavior.
8. Be able to demonstrate ways a teacher would develop the concept of quantity with K - 1 children. This would include identifying at least 3 teaching techniques, 3 teaching aides that would concretely illustrate the concept of "quantity" and at least 3 activities.

Activities:

1. Work chapter 3 in Matchett and Snader.
2. Read pp. 88 - 103 in Underhill.
3. Study chaper 2 in Spitzer. Also pp. 34 - 56 in Spitzer.
4. Read "Numbers, Sets and Counting" by Botts in the Arithmetic Teacher, Vol. 8, Oct. 1961, pp. 81 - 86.
5. Study experiments 7-12 in Copeland.
6. Review at least 2 different elementary mathematics text series. Note the sequence of development, activities used and appropriate grade levels for topecs in counting and numeration.

Evaluation:

1. A forty-five minute written quizz on the stated objectives.
2. A lesson plan which details a sequence of instruction designed to assist a child in learning a selected topic in counting and numeration.

MODULE 4
Numeration Systems

Goal: To study the sequential development of numeration systems from past to present.

Objectives: The student will:

1. Be able to give the characteristics of and write numerals in an additive numeration system.
2. Be able to give the characteristics of and write numerals in an additive - subtractive numeration system.
3. Be able to trace the development of systems of numeration including the appearance of a zero element, types of place value systems and major advantages and disadvantages of each type of system.
4. Be able to represent Hindu-Arabic numerals in expanded form.
5. Be able to illustrate a sequence of activities designed to develop in the child the concept of place value. This would include identifying at least 3 teaching techniques, 3 teaching aids that would concretely illustrate the place value concept and 3 activities.

Activities

1. Work pp. 119 - 128 in Matchett and Snader.
2. Review elementary text series and make a scope and sequence chart for the teaching of ancient numeration systems.
3. Read pp. 442 - 446 in Newman.
4. Read pp. 57 - 60 in Spitzer.
5. Construct at least two activities involving the teaching of place value using concrete materials.

Evalustion

1. Submit a lesson plan for teaching one of the above objectives to elementary children.
2. Submit the 2 activities constructed in Activity 5.
3. A forty-five minute quizz over the above objectives.
4. Submit the scope and sequence chart developed in Activity 2.

MODULE 5
Place Value Numeration Systems

Goal: To investigate in detail the characteristics of place value numeration systems including those with bases other than ten.

Objectives: The student will:

1. Be able to construct the sequence of counting numbers for a system using any base.
2. Be able to write a numeral in expanded form showing the value of each place.
3. Given a base ten numeral, be able to write an equivalent numeral in a specified numeration system.
4. Given a numeral in a specified numeration system, be able to write an equivalent numeral in the base ten system.
5. Be able to construct the addition operation table for a specified numeration system.
6. Be able to construct the multiplication operation table for a specified numeration system.
7. Be able to perform the four basic arithmetic operations in any specified numeration system.
8. Be able to demonstrate ways a teacher would develop the concept of equivalent numerals and the idea of numeration systems with bases other than ten. This would include at least 3 activities, 3 aids and 3 teaching techniques.

Activities

1. Work pp. 126 - 157 in Matchett and Snader.
2. Read pp. 60 - 70 in Spitzer.
3. Review the treatment of place value systems in elementary texts and develop a scope and sequence chart for this topic.
4. Develop at least 2 activities using concrete materials which would assist the child in understanding counting in numeration systems with bases other than ten.
5. Develop at least 2 activities using concrete materials which would assist the child in understanding arithmetic in numeration systems with bases other than ten.

Evaluation:

1. Submit a lesson for teaching one of the above objectives to elementary children.
2. A forty-five minute quizz over the above objectives.
3. Submit the scope and sequence chart developed in Activity 3.

Module 6

Operations On The Whole Numbers

Goal: To introduce working definitions of the four basic arithmetic operations, to investigate the various algorithms associated with these operations and to develop teaching strategies for these algorithms.

Objectives: The student will:

1. Be able to preform the four basic arithmetic operations.
2. Be able to define each of the basic operations using set notation.
3. Be able to relate the concept of place value to the use of certain algorithms.
4. Be able to demonstrate ways a teacher could assist a child in gaining an understanding of the underlying concepts of each basic operation. This would include 3 activties, 3 aids and 3 teaching techniques.
5. Be able to demonstrate ways a teacher could assist a child in gaining facility in the algorithms associated with the four basic operations. This would include at least 3 activities, 3 aids, and 3 teaching techniques.

Activities:

1. Read chapters 10,11,12 in Underhill.
2. Work chapter 4 in Hatchett and Snader.
3. Read pp. 101 - 112 and pp. 226 - 234 in Ashlock and Herman.
4. Review at least 2 elementary texts to note differences in the approaches to the various algorithms.
5. Perform several activities with the Cuisenaire rods. Utilize these to develop activities for teaching the basic operations.
6. View slide trays A and B concerning the four basic operations.

Evaluation

1. Submit a lesson plan which outlines a session or series of sessions designed to teach one of the concepts of this module.
2. A forty-five minute quizz over the objectives.

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Module 7
Operations on Rational Numbers

Goal: To introduce definitions of rational numbers, adapt the definitions of the 4 basic arithmetic operations to include rational numbers, to investigate the various algorithms associated with these operations and to develop teaching strategies for these algorithms.

Objectives: The student will:

1. Be able to identify numerals which represent rational numbers.
2. Be able to illustrate rational numbers with physical materials.
3. Be able to construct a family of fractions equivalent to a given fraction.
4. Be able to illustrate the four basic operations, as they relate to rational numbers, using physical materials.
5. Be able to demonstrate ways a teacher could assist a child in gaining facility in the algorithms associated with the four basic operations as they apply to rationsl numbers. This would include at least 3 activities, 3 aids and 3 teaching techniques.

Activities:

1. Work chapter 9 Sec. 1-5 in Matchett and Snader.
2. Read chapters 13, 14, 15 in Underhill.
3. Read H.L. Larson, "The Structure of Fractions", Arithmetic Teacher, April 1966, pp. 296-297.
4. Read Armstrong, Charles, "Fracedent - A Game using Equivalent Fractions, Decimals and Percents." Arithmetic Teacher, March 1972, pp. 222.- 223.
5. Read Green, George, "A Model for Teaching Multiplication of Fractional Numbers", Arithmetic Teacher, January 1973, pp. 5-7.
6. Review elementary texts to see how fractions are treated. In particular, notice the sequence of development.
7. Utilizing the Cuisenaire rods, develop two activities, one of which will assist the child in understanding the basic concept of a fraction and one of which will assist the child in gaining facility in the algorithms of the four basic operations on fractions.
8. View filmloop S-80075.
9. Review slide cartridge D - Rational Numbers.
10. Read Units 5,6,7,8 in Jencks and Peck.

Evaluation

1. Submit a lesson plan which outlines a session or series of sessions designed to teach one of the concepts of this module.
2. A forty-five minute quizz over the objectives.

Module 8
Measurement

Goal: To develop a basic understanding of the process of measurement and to develop facility in utilizing the English and Metric systems of measurement.

Objectives: The student will:

1. Be able to determine the child's readiness for measurement concepts.
2. Be able to describe measurement concepts in terms of comparisons.
3. Be able to define a measurement system in terms of arbitrary units.
4. Be able to make estimates of measures in both the English and Metric systems.
5. Be able to use both the English and Metric systems to accurately describe objects.
6. Be able to give a concrete definition of area.
7. Be able to determine the area of standard and non-standard figures.

Activities:

1. Work section 8-2 in Matchett and Snader.
2. Read experiments 24, 25, 26, 31 in Copeland.
3. Survey elementary texts to discover the sequence of topics in the teaching of measurement.
4. View the Think Metric slide series.
5. View the metric filmstrip/cassette module, "Introducing the Metric System" by Weber and Costello.

Evaluation:

1. Submit a lesson plan that details a session or series of sessions designed to teach one of the measurement concepts.
2. A forty-five minute quizz over the module's objectives.

Module 9
Geometry

Goal: To introduce the basic terminology used in elementary school, to study certain basic elementary figures and to illustrate the relationship of geometry to the rest of the elementary school program.

Objectives: The student will:

1. Be able to explain what each of the following geometric objects is and draw a sketch of it:
   (a) point, (b) line, (c) curve, (d) closed curve, (e) simple curve, (f) ray, (g) vertex, (h) edge, (i) parallel lines, (j) plane.
2. Be able to explain what each of the following is and draw a sketch of it: (a) plane angle, (b) triangle, (c) quadrilateral, (d) rectangle, (e) square.
3. Be able to explain what each of the following is and draw a sketch of it: (a) polygon, (b) regular polygon, (c) similar polygons, (d) congruent polygons, (e) convex polygons.
4. Be able to explain each of the following:
   (a) one-dimensional coordinate system, (b) two-dimensional coordinate system, (c) three-dimensional coordinate system.
5. Be able to state the basic topological properties of geometric figures.
6. Be able to outline the sequence of development of geometric topics in grades K-6.
7. Be able to explain the concept of a transformation including translations, rotations and reflections.

Activities:

1. Study chapter 18 in Underhill. Use this chapter to develop a list of definitions of terms in objectives 1, 2, 3. Accompany each definition with a sketch.
2. Work chapter 8 in Matchett and Snader.
3. Work with the geoboard to develop the concept of a transformation.
4. Read "Mathematical Games" by Jean Pedersen in the September 1971 issue of Scientific American.
5. Review elementary texts and methods texts to see how geometry is developed. Construct a scope and sequence chart for grades K-6.
6. Read pp. 3 - 22 in Flatland, A Romance of Many Dimensions by E. Abbott.

Evaluation:

1. Submit the scope and sequence chart developed in Activity 5.
2. Submit the list of definitions developed in Activity 1.